# Forensic Analysis of Lakota Artifacts



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# INTRODUCTION

This project examines a buffalo horn headdress. Among many Lakota tribes, the buffalo horn headdress is a prestigious item bestowed upon a leader. This artifact was donated to the Heritage Center Museum at the Red Cloud Indian School. Forensic analysis was conducted to authenticate provenance and manufacturing date of the headdress. A cultural investigation determined symbolism behind features such as designs, materials, and methods of manufacturing. The forensic analysis instruments used were the Video Spectral Comparator and X-Ray Fluorescence. Covert quick response (QR) codes were used with security printing technology to demonstrate effectiveness of in the Native American arts, crafts, and antiquities market.



Determine Lakota (Sioux) authenticity of Buffalo Horn Headdress through the following procedures.

#### **Cultural Investigation**

- · Features and Symbolism
- Historical Literature Referencing

#### **Forensic Analysis**

- Video Spectral Comparator (VSC)
- X-Ray Fluorescence (XRF)

#### **Broader Impact**

Artifact contains eagle feathers which are protected under federal laws.

- 1940 Bald and Golden Eagle Protection Act
- . U.S. Migratory Bird Treaty Act
- Native American Graves Protection and Repatriation Act



Fig. 3: Side profile - headdress

# **CULTURAL INVESTIGATION**

The investigation suggests this headdress is Lakota or Great Plains Indian. An inventory of the features is listed.

- · Buffalo hide crown
- · Buffalo horns
- · Beaded brow band
- Porcupine quillwork band
- · Stroud cloth trailer
- · 33 golden eagle feathers
- · 6 red-tail hawk feathers
- · General Service Officer U.S. Military buttons

### **Features and Symbolism**







#### **Beaded Brow Band**

- · Consistent with Sioux and Cheyenne symmetrical, geometric design
- Four apex designs with rectangles on the bottom
- Common Sioux method of stitching "lane stitching" Bright-colored, Czech seed beads (post 1920)
- Fig. 5: Center profile brow band

Fig. 7: Left profile - quillwork



Fig. 8: Center profile - quillwork



#### **Quillwork Band**

- Sioux. Chevenne, and Arapaho are known for excellent guillwork
- A band of guillwork connects the buffalo horns
- · Red, yellow, red, yellow symmetrical design



**Side Drops and Trailer Feathers** 

· Golden Eagle Feathers

Fig. 13: Profile of headdress

• Red-tail hawk feathers (side drops)





Fig. 13: Back mark (button)

**Military Buttons** · General Service Officer

Manufactured from 1854-1902

# **Historic Referencing**

### Lakota society - Tatanka Wapahun (Buffalo Headdress)

- Wore buffalo hair caps with horns and trailer
- Est. by Paints His Ear White (Lakota Sioux)

#### **General Service Officer Military Buttons**

- Uniforms used for tribal police
- Presented to surrendered Chief Crow King (Kangi Yatapi)

# **Forensic Analysis**

# **Video Spectral Comparator**

The VSC is a digital imaging systems equipped with high-resolution color camera, zoom lenses, ultra violet and visible infrared wavelength illumination sources.

- Feathers were analyzed under ultraviolet. infrared, and transmitted spot illumination
- No irregularities found under normal, ultraviolet, and infrared illumination
- Transmitted spot light DID NOT pierce the paint on the eagle feather replica
- Transmitted spot light pierced natural pigments in eagle feather and headdress feather



Fig. 15: Eagle feather



Fig. 16: Transmitted spot



Fig. 17: Transmitted spot light - Eagle Feather Replica light - Feather from trailer



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# X-Ray Fluorescence

XRF testing was performed using high-energy X-rays, or gamma rays, to excite particles within a material which may cause fluorescent emissions.

#### **Military Buttons**

· Copper, zinc, gold

#### **Buffalo Crown**

- Traditional method of tanning
- · No chromium in crown Ouillwork
- · Zinc, nickel, copper, lead, iron
- Too bright for traditional dye
- · Painted guills

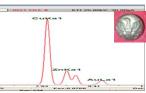


Fig. 19: XRF results - military button:

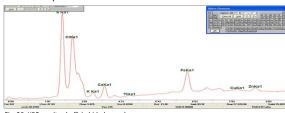


Fig. 20: XRF results - buffalo hide (crown)

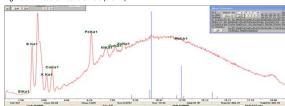


Fig. 21: XRF results - quillwork band (red pigment)

# CONCLUSION

Features on this headdress suggests the provenance to be Lakota or Cheyenne. Both are known for using "lane stitching" to make geometric, symmetrical designs with beads and quills. A historical Lakota Buffalo Society used a buffalo horn cap with a trailer. The golden eagle feathers match feathers from the National Eagle Repository. The high value of gold suggests the U.S. Military buttons are unlikely counterfeit. The headdress fashions Czech seed beads; which are brighter. This suggests the headdress could not have been made before the 1920s. Many traditional methods of manufacturing are employed. However, heavy metals detected in the red quills suggests they were painted.

# **PROOF OF CONCEPT**

#### **Covert Security Printing**

- Lanthanide doped β-NaYF4 nanoparticles
- · Invisible under ambient lighting conditions
- · Readable using a near-IR laser
- · Optomec Aerosol Jet Printer

#### **Quick Response Codes** · Stores more than 4,000 alpha-

- numerical characters · Links directly to a URL
- Track and trace application

